FCC Class B Test Report
For A Class B Digital Device

Client:

SanDisk Corporation
7 Atir Yeda Street
Kfar Saba, Israel
Phone 972-9-7644908

Device Under Test:

SanDisk SSD SATA 5000 2.5”

Document Number: 2007160
Reference Number: QRTL07-033

Test Overview:

Model No.:	SanDisk SSD SATA 5000 2.5”
Manufacturer’s Name:	SanDisk Corporation
Manufacturer’s Address:	7 Atir Yeda Street Kfar Saba, Israel
Manufacturer’s Contact:	Eitan Chalfon
Type of Equipment:	ITE
Serial No.:	713050010
Year of Manufacture:	2007
Location of Testing:	Rhein Tech Laboratories, Inc., Herndon, VA
Date of Receipt:	February 5, 2007
Date(s) of Testing:	April 10, 2007
Purpose of Testing:	FCC Class B Compliance

Standard(s) to which device was tested:

STANDARDS	SPECIFIC TESTS	APPLICABILITY ☒ *Tested* ☐ *Not Tested*
CFR47 Parts 15.109 and 15.107	Radiated and Conducted Emissions	☒

Test Engineer:	Jon Wilson	**Signature:**	
Report Written By:	Jon Wilson	**Signature:**	
Report Approved By:	Desmond Fraser	**Signature:**	
Report Number:	2007160		
Report Date:	April 27, 2007		

NVLAP® Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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1 GENERAL INFORMATION

The following test report for a Class B digital device is prepared on behalf of **SanDisk Corporation** in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Commissions Rules and Regulations. The Equipment Under Test (EUT) was the **SanDisk SSD SATA 5000 2.5"**. The test results reported in this document relate only to the items that were tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2003. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. Calibration checks are performed regularly on all test equipment.

All radiated and conducted emission measurements were performed manually at Rhein Tech Laboratories, Inc. The radiated emissions measurements were performed on the (three/ten) meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Va., 20170. Complete description and site attenuation measurement data has been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech Laboratories is accepted by the FCC as a facility available to do measurement work for others on a contract basis.

1.1 DEVIATIONS

There were no deviations from the test standard(s) and/or methods.

1.2 ACCREDITATION STATEMENTS

- NVLAP (USA): Accreditation under NVLAP Lab Code: 200061-0
- US CAB: Recognition as of U.S. Conformity Assessment Body (CAB) for EMC testing under US-EU and US-APEC MRA; IC accepted CAB under Phase I of APEC Telecommunication MRA. Identification number US0079.
- FCC (USA): Listing of test sites, Registration # 90902
- IC (Canada): Listing of test sites, IC 2956-1 and IC 2956-2
- US TCB (ATCB): Certification of cooperation, granted in 2005
- CE Notified Body: Rhein Tech Laboratories, Inc. has been approved by TNO Certification B.V. to provide EMC Test Reports and Technical Construction Files to TNO Certification B.V. Rheintech Certification number: 10118957
- AUSTEL (Australia): Acceptance as of a Listed Test House, A97/TH/0107
- ANATEL (Brazil, telecommunication): NCC certification for performing tests
- Ministry of Commerce (New Zealand): Approval of a test laboratory: ECR 3-9 BAE
- VCCI (Japan): Approval and registration of RTL test sites as R-1113 and C-1172

2 TEST DETAILS

2.1 PRODUCT DESCRIPTION

SanDisk SATA 5000 2.5" SSD is a drop-in replacement for the hard disk drive. It has no moving/ mechanical parts.

Features

o 2.5" small form factor supporting unformatted capacity of 32GB
o 9.5mm case height
o SATA 7+15 pins combo connector

Interface to host

o Standards: SATA 1.0a 1.5Gb/s

High performance

o Host transfer rate: 150MB/s
o Internal transfer read rate: 67MB/s
o Internal transfer write rate: 47MB/s
o Random Read (4KB): 5350 IOPS
o Average access time: 0.11msec

Low power consumption

o Supply voltage: 5Vdc
o Typical read/write: 190mA
o Typical idle: 125mA
o Typical standby: 70mA
o Typical sleep: 60mA

Reliability

o Mean time between failure (MTBF): 2,000,000 hours, based on Part Stress Analysis
o Operating shock: 1,500G, 0.5msec half sine
o Operating vibration: 2.17G, 7-500 Hz
o Operating temperature: 0˚C to 70˚C
o Non operating temperature and storage: -55˚C to 95˚C
o Operating temperature: 0˚C to 70˚C

2.2 MODIFICATIONS

None

2.3 EUT EXERCISE DESCRIPTION

The SanDisk SSD SATA 5000 2.5" was installed in a Class B laptop personal computer which was running Windows XP. The computer was programmed to transfer files continuously, to and from the device under test using a software application provided by Dell. The SanDisk SSD SATA 5000 2.5" was tested as a representative of the full line of available capacities. The only difference among the different sizes is the on-board flash memory. Otherwise, there are no physical, clock, or electronic changes. Determination of the 2.5 as the "worst case" test sample was determined by SanDisk based on preliminary scanning of the devices under test and engineering judgement that: because of the small changes between the various capacities, any changes in emission amplitudes or EMC susceptibility would be inconsequential.

2.4 EQUIPMENT UNDER TEST

Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test.

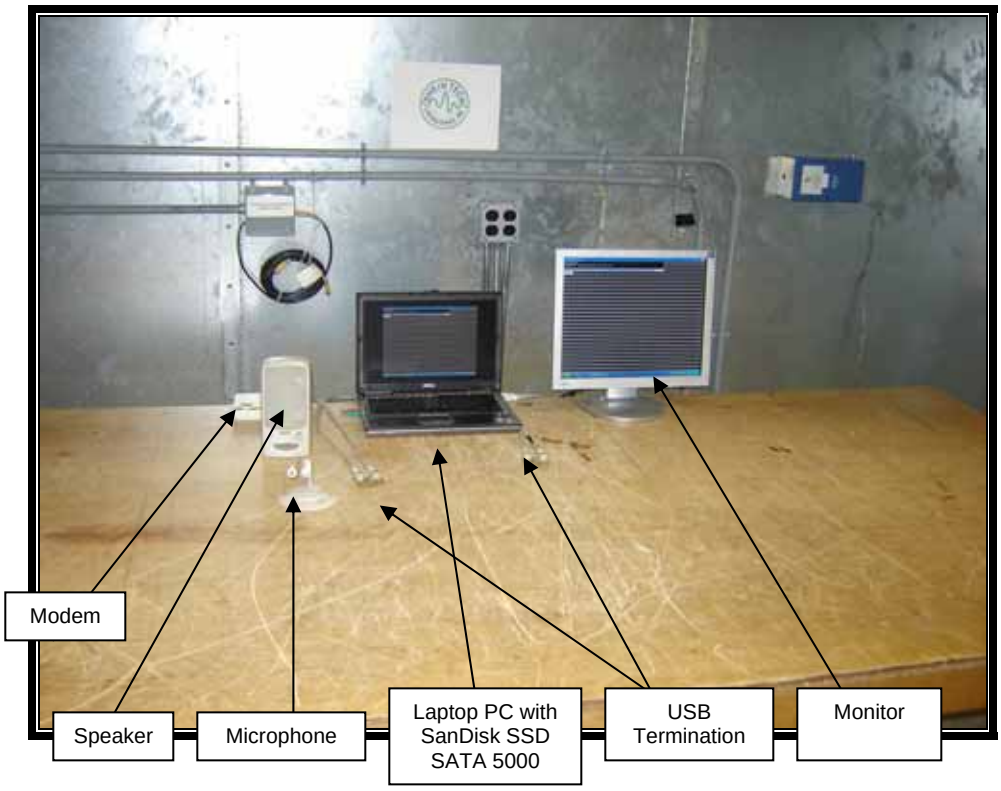
Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code	Equipment Arrival Date
SATA Storage Device	SanDisk Corporation	SanDisk SSD SATA 5000 2.5"	713050010	DoC	Internal	N/A	4/10/2007

Auxiliary Equipment

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code	Equipment Arrival Date
Laptop PC	Dell	Latitude D620 PP18L	N/A	DoC	Unshielded Power	N/A	4/10/2007
Laptop AC Adapter	Dell	LA65NS0-00	CN-0DF263-71615682-2ED4	N/A	Unshielded	017737	4/10/2007
Monitor	Mag Innovision	LT716s 700P	F6EQ58102818U	DoC	Unshielded Power Shielded I/O	901427	12/15/2005
Speaker	Boston Acoustics	BA265	7002305	N/A	Unshielded	011966	09/22/1999
USB Termination	Gateway, Inc.	USB PCB	Rev 1.0	N/A	Shielded	008645	04/07/1997
USB Termination	Gateway, Inc.	USB PCB	Rev 1.0	N/A	Shielded	011726	05/09/1996
Microphone	Gateway, Inc.	Telex	700358	N/A	Unshielded	016989	01/24/2006
Ethernet hub	Flowpoint	134	F258219	Class A Device	Unshielded Power	901278	10/04/2002
Modem	US Robotics	Sportster Model 0413	8390364644992	DoC	Unshielded Power Shielded I/O	900427	11/13/1996

2.5 CONFIGURATION OF TESTED SYSTEM



3 PRODUCT LABELLING/ INFORMATION TO THE USER

3.1 DOC LABEL ON DEVICE

The label shall be located in a conspicuous location on the device and shall contain the unique identification described in FCC CFR 47; Section 2.1074 (the unique model name), and the following DoC logo:

SanDisk Corporation SanDisk SSD SATA 5000 2.5”

FC

3.2 DOC STATEMENT IN USER’S MANUAL

For a Class B digital device or peripheral, per FCC CFR 47; Section 15.105, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
>
> —Reorient or relocate the receiving antenna.
> —Increase the separation between the equipment and receiver.
> —Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> —Consult the dealer or an experienced radio/ TV technician for help.

3.3 LOCATION OF LABEL ON EUT

4 CONDUCTED EMISSIONS

4.1 SITE AND TEST DESCRIPTION

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm /50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

4.2 CONDUCTED EMISSIONS TEST DATA

Mode: 115 vac, 60 Hz.

Neutral Conductor

Temperature: 75°F Humidity: 31%										
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/ Fail	
0.157	Qp	56.2	0.2	56.4	65.6	-9.2	55.6		Pass	
0.157	Av	33.4	0.2	33.6	65.6	-32.0	55.6	-22.0	Pass	
0.186	Qp	54.7	0.2	54.9	64.2	-9.3	54.2		Pass	
0.186	Av	21.8	0.2	22.0	64.2	-42.2	54.2	-32.2	Pass	
0.212	Qp	42.4	0.2	42.6	63.1	-20.5	53.1	-10.5	Pass	
0.221	Qp	43.7	0.2	43.9	62.8	-18.9	52.8	-8.9	Pass	
0.265	Qp	46.6	0.2	46.8	61.3	-14.5	51.3	-4.5	Pass	
0.320	Qp	54.0	0.3	54.3	59.7	-5.4	49.7		Pass	
0.320	Av	29.3	0.3	29.6	59.7	-30.1	49.7	-20.1	Pass	
0.372	Qp	51.7	0.3	52.0	58.5	-6.5	48.5		Pass	
0.372	Av	30.9	0.3	31.2	58.5	-27.3	48.5	-17.3	Pass	
0.710	Pk	40.4	0.2	40.6	56.0	-15.4	46.0	-5.4	Pass	
1.650	Pk	35.5	0.7	36.2	56.0	-19.8	46.0	-9.8	Pass	
4.450	Pk	35.6	1.3	36.9	56.0	-19.1	46.0	-9.1	Pass	
15.070	Pk	25.2	2.3	27.5	60.0	-32.5	50.0	-22.5	Pass	
17.640	Pk	28.2	2.5	30.7	60.0	-29.3	50.0	-19.3	Pass	
25.100	Pk	29.4	2.7	32.1	60.0	-27.9	50.0	-17.9	Pass	

Phase Conductor

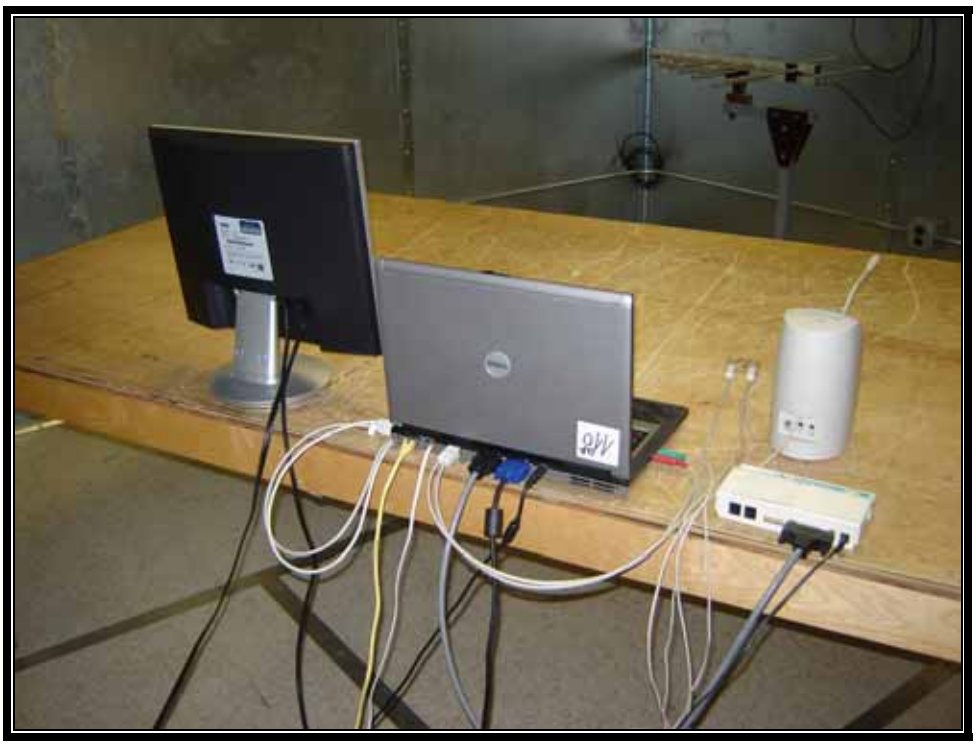
Temperature: 75°F Humidity: 31%										
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/ Fail	
0.155	Qp	58.5	0.2	58.7	65.7	-7.0	55.7		Pass	
0.155	Av	34.7	0.2	34.9	65.6	-30.7	55.6	-20.7	Pass	
0.186	Qp	54.5	0.2	54.7	64.2	-9.5	54.2		Pass	
0.186	Av	20.8	0.2	21.0	64.2	-43.2	54.2	-33.2	Pass	
0.213	Qp	52.2	0.2	52.4	62.7	-10.3	52.7		Pass	
0.213	Av	38.1	0.2	38.3	63.1	-24.8	53.1	-14.8	Pass	
0.265	Qp	46.6	0.2	46.8	61.3	-14.5	51.3	-4.5	Pass	
0.294	Qp	41.0	0.3	41.3	60.4	-19.1	50.4	-9.1	Pass	
0.377	Qp	39.8	0.3	40.1	58.3	-18.2	48.3	-8.2	Pass	
0.423	Qp	39.6	0.2	39.8	57.4	-17.6	47.4	-7.6	Pass	
0.500	Pk	38.5	0.2	38.7	56.0	-17.3	46.0	-7.3	Pass	
2.740	Pk	31.2	1.0	32.2	56.0	-23.8	46.0	-13.8	Pass	
9.910	Pk	24.0	1.9	25.9	60.0	-34.1	50.0	-24.1	Pass	
18.640	Pk	28.0	2.6	30.6	60.0	-29.4	50.0	-19.4	Pass	
25.070	Pk	29.8	2.7	32.5	60.0	-27.5	50.0	-17.5	Pass	
28.850	Pk	22.2	3.1	25.3	60.0	-34.7	50.0	-24.7	Pass	

Result: PASS

Test Personnel:

Jon Wilson		April 10, 2007
Tester	Signature	Date of Test

4.3 CONDUCTED TEST PHOTOGRAPHS



5 RADIATED EMISSIONS

5.1 SITE AND TEST DESCRIPTION

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoor at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meter above the ground plane. The spectrum was examined as per FCC part 15 specifications.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, measurement use an average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

5.2 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBuV - 11.5 dB/m = 37.8 dBuV/m

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

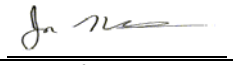
5.3 RADIATED EMISSIONS TEST DATA

Temperature: 48°F Humidity: 36%											
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail	
50.000	Qp	H	200	3.0	38.4	-22.2	16.2	30.0	-13.8	Pass	
73.800	Qp	V	100	1.0	41.6	-23.5	18.1	30.0	-11.9	Pass	
144.000	Qp	V	5	1.0	40.1	-18.5	21.6	30.0	-8.4	Pass	
191.992	Qp	V	80	1.0	42.2	-19.4	22.8	30.0	-7.2	Pass	
200.000	Qp	V	190	1.0	35.3	-19.0	16.3	30.0	-13.7	Pass	
225.000	Qp	V	290	1.0	32.7	-18.5	14.2	30.0	-15.8	Pass	
250.000	Qp	H	160	4.0	44.2	-15.5	28.7	37.0	-8.3	Pass	
369.340	Qp	H	190	1.5	42.8	-12.1	30.7	37.0	-6.3	Pass	
406.340	Qp	V	270	1.0	32.9	-10.5	22.4	37.0	-14.6	Pass	
463.850	Qp	H	75	2.5	38.8	-9.5	29.3	37.0	-7.7	Pass	
485.970	Qp	V	190	1.0	29.4	-8.9	20.5	37.0	-16.5	Pass	
631.945	Qp	V	45	1.0	30.8	-6.2	24.6	37.0	-12.4	Pass	
700.000	Qp	V	5	1.0	30.4	-5.8	24.6	37.0	-12.4	Pass	

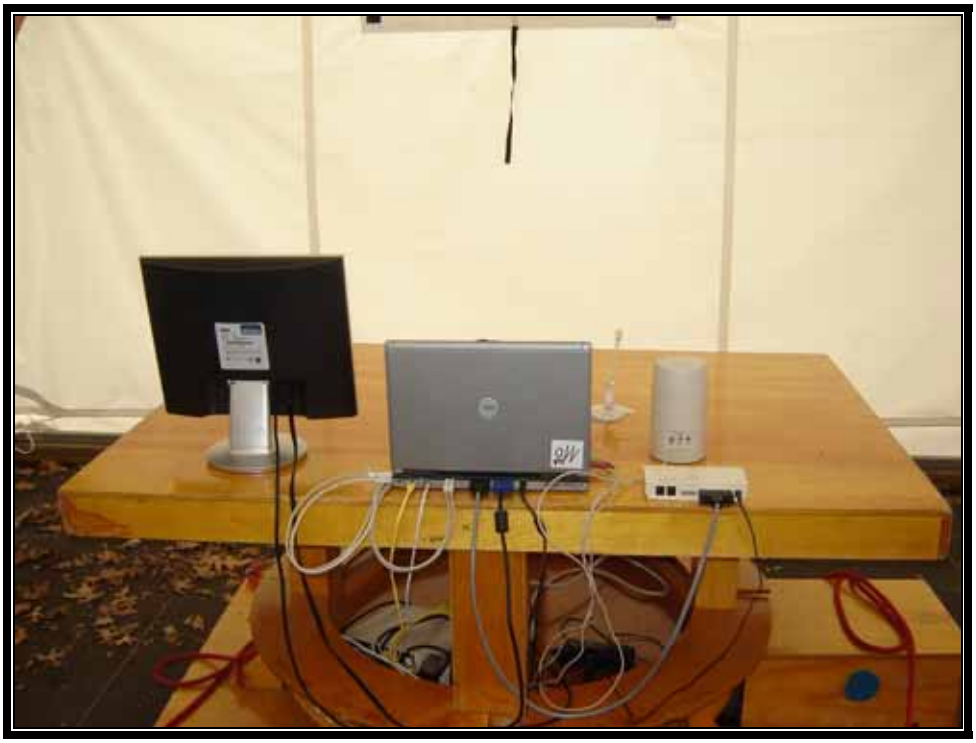
Note:
The EUT was scanned from 30 MHz to 15,000 MHz. All emissions other than those listed in the tables above were found to have amplitudes attenuated by more than 20dB below the FCC limit.

Result: Pass

Test Personnel:

Jon Wilson		April 10, 2007
EMC Test Engineer	Signature	Date Of Test

5.4 RADIATED TEST PHOTOGRAPHS



6 EMISSIONS EQUIPMENT LIST

The following is a list of equipment Rhein Tech uses to perform testing.

Part Type	Manufacturer	Model	Serial Number	Barcode	Cal Due Date
Conducted Emissions (SR2, SA3)					
Spectrum Analyzer (10kHz-1.5GHz)	Hewlett Packard	8567A	2602A00160	900968	8/14/2007
Spectrum Analyzer Display Section	Hewlett Packard	85662A	2542A11239	900970	8/14/2007
Quasi-Peak Adapter	Hewlett Packard	85650A	2521A00743	900339	8/14/2007
Filter	Solar	8130	947306	900729	N/A
16A LISN	AFJ International	LS16/110VAC	16010020080	901083	4/4/2008
16A LISN	AFJ International	LS16/110VAC	16010020081	901082	1/6/2008
Current Probe (Telecom conducted)	Fischer Custom Communications	F-14-1	33	901084	8/31/2007
Emissions testing software	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Rev. 14.0.2	N/A	N/A
Radiated Emissions					
EMI Receiver RF Section, 9 KHz - 6.5 GHz	Hewlett Packard	85462A	3325A00159	900913	3/21/2008
RF Filter Section, 100 KHz to 6.5 GHz	Hewlett Packard	85460A	3330A00107	900914	3/21/2008
Amplifier	RTL	PR-1040	1004	901281	1/19/2008
Bi-Log Antenna (20MHz-2GHz)	Schaffner Chase	CBL6112B	2648	901053	11/1/2007
Emissions testing software	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Rev. 14.0.2	N/A	N/A

7 MANUFACTURER'S EQUIPMENT FILE CHECKLIST (PER FCC RULES §2.1075)

This checklist shall be used by the manufacturer to verify the correct filing per FCC 2.1075 Retention of records for products produced and marketed.

PRODUCT MODEL(s): Records Verified By:

SanDisk SSD SATA 5000 2.5"

A record of the original design drawings and specifications.	
A record of all changes that have been made that would affect continued compliance with the authorized unit (e.g., any changes which would require a Class I or Class II permissive change).	
A record of the procedures used for production inspection and testing (if tests were performed) to ensure ongoing conformance.	
A record of the measurements made on an appropriate (NVLAP-accredited) test site that demonstrates compliance. The record shall contain:	
• (i) The actual date or dates testing was performed;	
• (ii) The name of the test laboratory, or individual performing the testing. (The Commission may request additional information regarding the test site, the test equipment or the qualifications of the Test laboratory from the client. or individual performing the tests);	
• (iii) A description of how the device was actually tested, identifying the measurement procedure and test equipment that was used contained in the test report	
• (iv) A description of the equipment under test (EUT) and support equipment connected to, or installed within the EUT	
• (v) The identification of the EUT and support equipment by trade name and model number and, if appropriate, by FCC identifier and serial number;	
• (vi) The types and lengths of connecting cables used and how they were arranged or moved during testing;	
• (vii) At least two photographs showing the test set-up for the highest line conducted emission and showing the test set-up for the highest radiated emission. These photographs must be focused originals which show enough detail to confirm other information contained in the test report;	
• (viii) A description of any modifications made to the EUT Client, or individual to achieve compliance with the regulations;	
• (ix) All of the data required to show compliance with the appropriate regulations;	
• (x) The signature of the individual responsible for testing the product along with the name and signature of an official of the responsible party, as designated in §2.909;	
• (xi) A copy of the compliance information (i.e., the DoC), as described in §2.1077, required to be provided with the equipment as follows: (a) Identification of the product (name and model number); (b) The unique model name and FCC DoC logo information as specified in §15.19(b)(1) and §15.105, that the product complies with Part 15 of the FCC Rules; (c) Identification, by name, and address of the responsible party.	